

REMARKS

Claims 1-5 will be in this application after entry of the above set of claims. Claim 1 has been amended, Claim 3 cancelled and new Claim 5 added.

The drawing corrections requested by the Draftsperson will be submitted once the claims have been found in condition for allowance.

Claims 1-4 have been rejected under 35 USC 112 as being indefinite. Claim 1 has been amended to overcome the Examiner's objections. In particular, a semi-colon has been added in line 4 between the words "connections" and "forming" in order to make it clear that plating is a step that precedes the next step of forming etching resist layers. The word "thereby" has been deleted and replaced with "and thereafter" in line 5 to separate the step of developing the etching resist layers from the step of etching the circuit. Other amendments have been made, which are believed to further add clarity without adding limitations to Claim 1.

New Claim 5 adds the use of a carrier foil, which is the preferred method of creating the wavy foils that are more easily drilled with a carbon dioxide laser.

Claims 1 and 3-4 have been rejected under 35 USC 103(a) as unpatentable (i.e. obvious) over Urasaki et al (Urasaki) in view of Yates. Urasaki is cited for use of a carbon dioxide laser to drill via holes, for use of plating to form an electrical connection, and for use of etching resists. Yates is cited for forming a waved copper foil for improving bonding to a resin substrate. These references are not sufficient individually and in combination to make the present invention obvious.

The Applicant's invention relates to the use of rough external foils to make possible the drilling of vias with a carbon dioxide laser. As explained at page 4, lines 1-5, it has been necessary to etch away an area on the surface of external copper foils to expose the resin when using a carbon dioxide laser. As shown in Figure 3, the roughness of the foil is

important to reduce reflecting of the laser which makes possible drilling of vias without first removing copper from the area to be drilled. The optimum roughness is shown to be about 10 to 20 μm Rz, but a wider range is possible, which has been included in Claim 1 in order to define the meaning of “wavy”.

While Urasaki does disclose the use of a carbon dioxide laser, he apparently was using the prior art procedure described by the Applicants. That is, he etched away the copper to expose the resin before drilling with the carbon dioxide laser. See Column 9, lines 39-44 of the Urasaki patent. He did not suggest that vias could be made directly through copper foil, as the Applicants teach.

Yates discloses a method of smoothing the roughness of the matte side of copper foil by depositing particles in the valleys. Yates object was to make a uniform roughness having an Rz value of 3-8. There is no suggestion that the exposed side would have a roughness such that it could be drilled with a carbon dioxide laser. Combining Yates with Urasaki would leave one skilled in the art with a more uniform foil, but not with a surface that could be drilled with a carbon dioxide laser.

Claim 2 has been rejected under 35 USC 103(a) as unpatentable over Urasaki in view of Yates and further in view of Ando et al (Ando), who is cited for the use of rust prevention layers. Claim 2 depends from Claim 1. If Claim 1 is patentable, as argued above, then Claim 2 should also be patentable, since Ando does not overcome the deficiencies of the principal references.

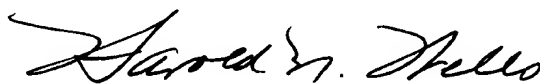
Gaku et al has been noted for their use of a carbon dioxide laser. However, their method involves applying a metal powder in plastic to improve drilling effectiveness. Thus, Gaku et al do not suggest the present invention or overcome the defects of the other references.

Okano et al was cited for the use of roughened copper foils. However, it appears from column 13 that the exposed copper was etched away before laser drilling. Therefore, Okano et al teaches the prior art method, as did Urasaki.

In view of the amendments that have been made and the above discussion showing the cited references to be lacking, the Examiner is asked to reconsider and to allow the amended claims. If further amendment is believed to be needed, the Examiner is invited to contact the Applicant's attorney at the telephone number provided below.

Respectfully submitted,

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